

PubH 6177
Nanotechnology Health and Safety
Fall 2018

Credits:	3
Meeting Days:	Mondays
Meeting Time:	10:10 AM-12:05 PM
Meeting Place:	Moos 2-120
Instructor:	Dr. Peter Raynor, Professor, Division of Environmental Health Sciences
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Office Hours:	By appointment

I. Course Description

As defined by ASTM, nanotechnology is the emerging field of “technologies that measure, manipulate, or incorporate materials and/or features with at least one dimension between approximately 1 and 100 nm”. Toxicology studies have indicated that exposures to nanomaterials present unique health risks not encountered with their parent materials. After completing this course, students will understand how the fundamental concepts and methods of occupational hygiene are applied specifically to nanomaterials. Students will learn to use aerosol science, toxicology, product lifecycle assessment, exposure assessment, and occupational hygiene data interpretation methods comprehensively to evaluate workers’ disease risks from nanomaterial exposures and to guide intervention efforts. Emphasis will be placed on control measures appropriate for nanomaterials, and control banding approaches when data are lacking. Participants will study the handling of waste products and potential impacts of released nanoparticles on the public and the ambient environment. The course is aimed at graduate and upper-level undergraduate students in the health and basic sciences, engineering, public health, and industrial hygiene.

Acknowledgments:

Dr. Raynor, the instructor, developed the lesson content of PubH 6177 with Dr. Gurumurthy Ramachandran, formerly from the University of Minnesota and now from Johns Hopkins University, and Dr. Tom Peters, from the University of Iowa, as part of the Midwest Emerging Technologies Public Health and Safety Training (METPHAST) Program funded by the National Institute of Environmental Health Sciences (NIEHS). University of Minnesota research assistants Austin Bell, Chinomso Ibe, and Adepeju Adesina worked with Dr. Raynor to develop hands-on activities. Deb Newberry from Dakota County Technical College and Ruth

Rasmussen from the University of Minnesota helped review and edit content. Erin Coyer from the SPH Office of E-Learning Services provided video editing services.

II. Course Prerequisites

Environmental Health major, or completion of PubH 6102, or permission of the instructor.

III. Course Goals and Objectives

By the end of the course, students should be able to:

- Define important terms related to nanotechnology health and safety
- Recognize scenarios that could produce nanomaterial exposures among workers
- Explain the potential health effects resulting from exposures to nanomaterials
- List regulations and guidelines related to the health and safety of working with nanomaterials
- Propose methods to evaluate workplace exposures to nanomaterials in a particular situation
- Recommend ways to control workplace exposures to nanomaterials
- Identify possible routes of exposure to nanomaterials through the ambient environment
- Describe what has been learned using effective written, oral, and visual communication

IV. Methods of Instruction and Work Expectations

This course, comprised of 14 lessons, will combine on-line learning with face-to-face meetings. As part of each lesson, students will watch a video presentation on the course Moodle site (<http://moodle.umn.edu>) that lasts about one hour and answer knowledge check questions regarding the videos. Subsequent to viewing the presentation, students will meet with the instructor in class to perform a hands-on activity and work on quantitative example problems relevant to homework assignments. After each class session, students will complete a homework assignment due through Moodle prior to the following class. A midterm examination and a final examination will be administered through Moodle during the course. Two 1-hour tours will be included as part of the face-to-face meetings. One face-to-face meeting will include a video and a discussion on social and ethical issues related to nanotechnology.

The on-line video presentation will require about 1 hour per week, face-to-face instruction will require two hours per week. The homework assignments and examinations are expected to require less than six hours per week outside of class.

V. Course Text and Readings

There is no text for this course.

VI. Course Outline/Weekly Schedule

September 10, 2018: Introduction to Nanotechnology
View Video Lesson #1 and answer knowledge checks
Perform Hands-on Activity #1

September 17, 2018: Exposures to Raw Nanomaterials
View Video Lesson #2 and answer knowledge checks
Perform Hands-on Activity #2
Submit Homework Assignment #1

September 24, 2018: Exposures to Nanomaterials in Products
View Video Lesson #3 and answer knowledge checks
Tour University of Minnesota Nano Center
Perform Hands-on Activity #3
Submit Homework Assignment #2

October 1, 2018: Nanomaterials in the Environment
View Video Lesson #4 and answer knowledge checks
Perform Hands-on Activity #4
Submit Homework Assignment #3

October 8, 2018: Nanoparticle Health Effects

View Video Lesson #5 and answer knowledge checks
In-class video *Social and Ethical Issues in Nanotechnology* with discussion
Perform Hands-on Activity #5
Submit Homework Assignment #4

October 15, 2018: Sampling Instrumentation for Airborne Nanomaterials

View Video Lesson #6 and answer knowledge checks
Perform Hands-on Activity #6
Submit Homework Assignment #5

October 22, 2018: Sampling Strategies for Airborne Nanomaterials

View Video Lesson #7 and answer knowledge checks
Perform Hands-on Activity #7
Submit Homework Assignment #6

By October 26, 2018:

Mid-Term Examination

October 29, 2018: Assessing Dermal Exposures for Nanomaterials

View Video Lesson #8 and answer knowledge checks
Perform Hands-on Activity #8
Submit Homework Assignment #7

November 5, 2018: Standards and Regulations Pertinent to Nanomaterials

View Video Lesson #9 and answer knowledge checks
Perform Hands-on Activity #9
Submit Homework Assignment #8

November 12, 2018: Work Practice & Administrative Controls and PPE for Nanomaterials

View Video Lesson #10 and answer knowledge checks
Perform Hands-on Activity #10
Submit Homework Assignment #9

November 19, 2018: Engineering Controls for Nanomaterials

View Video Lesson #11 and answer knowledge checks
Tour facility with 3D printers (exact location and date still to be verified)
Perform Hands-on Activity #11
Submit Homework Assignment #10

November 26, 2018: Cleaning Nanoparticles from Air

View Video Lesson #12 and answer knowledge checks
Perform Hands-on Activity #12
Submit Homework Assignment #11

December 3, 2018: Special Situations and Affiliated Hazards for Nanomaterials

View Video Lesson #13 and answer knowledge checks
Perform Hands-on Activity #13
Submit Homework Assignment #12

December 10, 2018: Disposal of Nanomaterials

View Video Lesson #14 and answer knowledge checks
Perform Hands-on Activity #14
Submit Homework Assignment #13

December 17, 2018:

Submit Homework Assignment #14

By December 20, 2018:

Final Examination

VII. Evaluation and Grading

For all assignments and exams, partial credit will be awarded generously. In addition, the neatness of the work and good grammar in your writing are important because the instructor will be able to follow the students' reasoning more easily when trying to award partial credit. The breakdown of grading for the course is:

Knowledge Checks	10 %
Participation in Activities	10 %
Homework Assignments	50 %
Midterm Examination	15 %
Final Examination	15 %

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:

<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Final grades will be assigned as follows:

A 4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements

A- 3.667

B+ 3.333

B 3.000 - Represents achievement that is significantly above the level necessary to meet course requirements

B- 2.667

C+ 2.333

C 2.000 - Represents achievement that meets the course requirements in every respect

C- 1.667

D+ 1.333

D 1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements

S Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to:

<http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html>.

Course Evaluation

The SPH will collect student course evaluations electronically using a software system called CourseEval: www.sph.umn.edu/courseeval. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: www.sph.umn.edu/grades. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

Incomplete Contracts

A grade of incomplete "I" shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an "I" requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements.

Extension for completion of the work will not exceed one year (or earlier if designated by the student's college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: www.sph.umn.edu/grades.

University of Minnesota Uniform Grading and Transcript Policy

A link to the policy can be found at onestop.umn.edu.

VIII. Other Course Information and Policies

Grade Option Change (if applicable)

For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at onestop.umn.edu.

Course Withdrawal

Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html>.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <http://www1.umn.edu/oscai/integrity/student/index.html>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: <http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: <http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

Mental Health and Stress Management

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

The Office of Student Affairs at the University of Minnesota

The Office for Student Affairs provides services, programs, and facilities that advance student success, inspire students to make life-long positive contributions to society, promote an inclusive environment, and enrich the University of Minnesota community.

Units within the Office for Student Affairs include, the Aurora Center for Advocacy & Education, Boynton Health Service, Central Career Initiatives (CCE, CDes, CFANS), Leadership Education and Development – Undergraduate Programs (LEAD-UP), the Office for Fraternity and Sorority Life, the Office for Student Conduct and Academic Integrity, the Office for Student Engagement, the Parent Program, Recreational Sports, Student and Community Relations, the Student Conflict Resolution Center, the Student Parent HELP Center, Student Unions & Activities, University Counseling & Consulting Services, and University Student Legal Service.

For more information, please see the Office of Student Affairs at <http://www.osa.umn.edu/index.html>.

Academic Freedom and Responsibility:

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Student Academic Success Services (SASS): <http://www.sass.umn.edu>

Students who wish to improve their academic performance may find assistance from Student Academic Support Services. While tutoring and advising are not offered, SASS provides resources such as individual consultations, workshops, and self-help materials.